

Amendment and Response

Applicant: Cory Watkins et al.

Serial No.: 10/073,426

Filed: February 11, 2002

Docket No.: A126.143.101

Title: CONFOCAL 3D INSPECTION SYSTEM AND PROCESS

REMARKS

This Amendment is responsive to the Final Office Action mailed February 26, 2004. In that Office Action, the Examiner rejected claims 1, 2, 8, 9, 16, 20, and 21 under 35 U.S.C. §103(a) as being unpatentable over Corle et al., U.S. Patent No. 5,067,805 ("Corle") in view of Doemens et al., U.S. Patent No. 5,991,040 ("Doemens"). Claims 3-7, 10-15, and 17-19 were rejected under 35 U.S.C. §103(a) as being unpatentable over Corle and Doemens as applied to claims 1, 2, 8, 9, 16, 20, and 21, and further in view of McCarthy et al., U.S. Patent No. 4,802,748 ("McCarthy").

With this Response, claims 1, 8, and 16 have been amended. Claims 1-21 remain pending in the application and are presented for reconsideration and allowance.

35 U.S.C. §103 Rejections

On pages 2 and 3 of the Office Action, the Examiner rejected claims 1, 2, 8, 9, 16, 20, and 21 under 35 U.S.C. §103(a) as being unpatentable over Corle in view of Doemens. The Examiner indicated that Corle discloses a non-laser, confocal scanning optical microscope in which the light source is a white light such as an arc lamp, referencing column 1, line 40 and column 3, lines 41-44. The Examiner indicated that Corle does not teach that the confocal optical microscope can be used to inspect the projection on a substrate. The Examiner further indicated that Doemens teaches a measurement system according to the confocal principal for inspecting the projections of soldering bumps in ball grid arrays of a semiconductor substrate, referencing Figure 1, column 1, lines 14-25 and column 2, lines 47-52.

As a starting point, it is respectfully noted that the Examiner's reference to column 1, lines 14-25 of Doemens as teaching general use of a confocal system to inspect projections on microelectronics is misplaced. To the contrary, the cited language provides that conventional (i.e., non-confocal) three-dimensional sensors are unsatisfactory. Doemens further explains that confocal systems have been viewed as a possible replacement for conventional inspection devices (Doemens, column 2, lines 38-48). However, Doemens concludes that known confocal microscopes/sensors are not capable of achieving rapid inspection (Doemens, column 1, line 49 – column 2, line 29). Doemens overcomes these deficiencies with a specifically designed

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confocal optical system. Thus, to the extent Doemens is viewed as providing necessary teaching for the claim limitation of “rapidly inspect projections” or “rapidly determine projection heights”, such teaching is limited to the specific system/structure embodiments of Doemens. By Doemens’ own admission, any other confocal system is adequate.

With this Amendment, independent claim 1 has been amended such that the inspection device is adapted to rapidly determine projection heights based upon light intensities identified during a plurality of passes, with the confocal sensor remaining stationary relative to the light source during each pass. None of the cited references teach or otherwise suggest at least these limitations. In particular, Corle describes a standalone microscope used for illuminating and viewing discrete locations on a surface. That is to say, Corle is a simple microscope; as agreed by Doemens, it cannot rapidly determine projection heights. Doemens discloses an optical distance sensor used in the fabrication of semiconductors to inspect three-dimensional characters. However, Doemens does not employ a plurality of passes. Rather, Doemens discloses a single pass of multiple light sources over a semiconductor. There is no disclosure, teaching, or suggestion to identify bump locations and bump elevations via multiple passes. Further, during the single pass, Doemens requires that the confocal sensor (i.e., the receiving unit 4) move or oscillate along the optical axis, and thus relative to the light source (Doemens, column 4, lines 54-65). Thus, modifying Corle in view of Doemens to provide an inspection device capable of rapidly determining projection heights requires this same construction, in direct contrast to the limitations of amended claim 1. As such, it is respectfully submitted that independent claim 1, as well as claims depending therefrom, are allowable over the cited references.

Independent claim 8 has been amended such that the inspection device is adapted to rapidly determine projection heights over an entire surface of the substrate. Neither the Corle nor Doemens reference discloses at least this limitation. As previously discussed, Corle discloses a simple microscope for illuminating and viewing discrete locations on a surface. Doemens specifically discloses that the structure of the sensor and the inspection rates that can be achieved with the sensor are practical only when the regions of electronic components that are sensed by means of the sensor are only approximately 5 percent of the total circuit board assembly, such as the edge regions in which solder joints to be checked are located. Since

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Doemens is only capable of scanning approximately 5 percent of a total printed circuit board assembly (see Doemens, column 5, lines 36-43), identification of projection heights over an entire surface of the substrate is not possible. As such, it is respectfully submitted that independent claim 8, as well as claims depending therefrom, are allowable over the cited references.

Independent claim 16 has been amended such that the inspection device is adapted to rapidly determine projection heights based upon light intensities identified during a plurality of passes of light from the light source at differing optical elevations of the light source relative to the substrate. As previously discussed with reference to amended claim 1, neither Corle nor Doemens discloses at least this limitation. Again, in order to arrive at the combination asserted by the Examiner, Doemens teaches that the only confocal system capable of performing rapid inspection is the specific embodiment set forth therein. Thus, all elements of Doemens must be part of the asserted combination. Doemens does not teach multiple passes or differing optical elevations of the light source relative to the substrate. As such, it is respectfully submitted that independent claim 16, as well as claims depending therefrom, are allowable over the cited references.

On pages 3 and 4 of the Office Action, the Examiner rejected claims 3-7, 10-15, and 17-19 under 35 U.S.C. §103(a) as being unpatentable over Corle and Doemens as applied to claims 1, 2, 8, 9, 16, 20, and 21, and further in view of McCarthy. Claims 3-7, 10-15, and 17-19 are dependent claims. As previously discussed, it is believed that all independent claims are allowable over the cited references. Therefore, it is also believed that all dependent claims are allowable over the cited references.

Allowable Subject Matter

In light of the above, Applicant believes independent claims 1, 8, and 16, and the claims depending therefrom, are in condition for allowance. Allowance of these claims is respectfully requested.

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CONCLUSION

No fees are required under 37 C.F.R. 1.16(b)(c). However, if such fees are required, the Patent Office is hereby authorized to charge Deposit Account No. 50-0471. The Examiner is invited to contact the Applicants' Representative at the below-listed telephone number if there are any questions regarding this response.

Respectfully submitted,

Cory Watkins et al.,

By their attorneys,

DICKE, BILLIG & CZAJA, PLLC

Fifth Street Towers, Suite 2250

100 South Fifth Street

Minneapolis, MN 55402

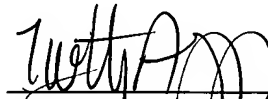
Telephone: (612) 573-2004

Facsimile: (612) 573-2005

Date:

August 26, 2004

TAC:jmc

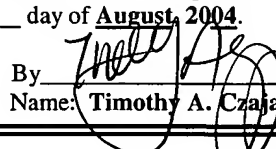


Timothy A. Czaja
Reg. No. 39,649

CERTIFICATE UNDER 37 C.F.R. 1.8:

The undersigned hereby certifies that this paper or papers, as described herein, are being deposited in the United States Postal Service, as first class mail, in an envelope address to: Mail Stop RCE, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on this 26th day of August, 2004.

By


Name: Timothy A. Czaja